Claims

1. A method of producing thermoplastic hydrogels for use in producing contact lenses, comprising the step of reacting one or more from the list;
   polyethylene oxide,
   polyol,
   polyamine,
   with a polyisocyanate and a polyfunctional amine or polyalcohol.

2. A method of producing thermoplastic hydrogels for use in producing contact lenses, comprising the step of reacting one or more from the list
   polyethylene oxide
   polyol
   polyamine
   and a polyisocyanate that is prepared using a range of NCO:OH or NCO:NH_2 ratios.

3. A method of producing thermoplastic hydrogels as in Claims 1 or 2 wherein the polyol is polyethylene glycol.

4. A method of producing thermoplastic hydrogels as in any of the previous Claims wherein the method also comprises the step of end capping unreacted groups with a unit capable of producing hydrogen bonding, π bonding, ionic bonding, hydrophobic bonding and/or phase separation or forming a glassy or crystalline phase separated domain.

5. A method of producing thermoplastic hydrogels as in Claims 1 - 3 wherein the method also comprises the step of end capping unreacted groups with a unit from a list of:
Mono-functional amine
Mono-functional isocyanate
Mono-functional anhydride
Mono-functional acid
A cyclic diacid anhydride
Mono-functional alcohol

6. A method of producing thermoplastic hydrogels as in any of the previous Claims wherein a biodegradable unit may be incorporated.

7. A method of producing thermoplastic hydrogels as in Claim 6 wherein biodegradable unit may be polycaprolactone, poly (lactic acid), poly(glycolic) acid or poly(hydroxybutyric)acid, amine or hydroxyl ended poly(amino) acids (protein or peptide analogues).

8. A method of producing thermoplastic hydrogels as in any of the previous Claims wherein the ratios of the components are selected such that, at complete reaction, the product does not form a macrogel.

9. A method of producing thermoplastic hydrogels as in any of the previous Claims wherein the reaction is prepared using a range of NCO:OH or NCO:NH_2 ratios from 2:1 to 1:2.

10. A method of producing thermoplastic hydrogels as in any of the previous Claims wherein where both OH and

NH_2 groups are used within the single reaction, a range of NCO:(OH+NH_2) ratios of 2:1 to 1:2.

11. A method of producing thermoplastic hydrogels as in any of the previous Claims wherein the first step reaction is prepared using NCO:OH or NCO:NH_2 ratios of 2.0:1 to 1:1.8 and 1.8:1 to 1:1.8.

12. A method of producing thermoplastic hydrogels as in any of the previous Claims wherein the range of ratios used may be extended by the addition of monofunctional amines, alcohols or cyanates.

13. A method of producing thermoplastic hydrogels as in any of the previous Claims wherein a macrogel is prevented from forming by stopping the reaction before completion.

14. A method of producing thermoplastic hydrogels as in Claim 13 wherein the reaction is stopped by the addition of a monoamine, an amine terminated polymer, a mono-alcohol or an alcohol terminated polymer.

15. A method of producing thermoplastic hydrogels as in Claim 14 wherein the monoamine, mono-alcohol, amine terminated polymer or alcohol terminated polymer is added when the reaction is partially complete.

16. A method of producing thermoplastic hydrogels as in Claims 1-12 wherein an amine or alcohol is admixed at the outset thus removing the possibility of gelation.

17. A method of producing thermoplastic hydrogels as in Claim 16 wherein the amine is added in the form of amine carbonate.

18. A method of producing thermoplastic hydrogels as any of the previous Claims wherein products with NCO end groups are subjected to a final curing by immersion in liquid water or steam after moulding.

19. A method of producing thermoplastic hydrogels as in any of the previous Claims wherein, after the initial reaction, a second stage occurs, and in the second stage the unreacted groups are capped with an amine.

20. A method of producing thermoplastic hydrogels as in Claim 19 wherein unreacted NCO groups are endcapped.

21. A method of producing thermoplastic hydrogels as in Claim 19 wherein unreacted OH groups are endcapped.

22. A method of producing thermoplastic hydrogels as in Claims 19 and 20 wherein terminal NCO groups are converted into a strongly hydrogen bonding urea group.

23. A method of producing thermoplastic hydrogels as in Claims 19-22 wherein the unreacted groups are capped with an aliphatic amine.

24. A method of producing thermoplastic hydrogels as in Claim 23 wherein the amine group is attached to a long linear or branched alkyl group or to an aryl- or aralkyl-amine.

25. A method of producing thermoplastic hydrogels as in Claim 23 wherein the amine group is attached to polymers or low molecular weight pre-polymers.

26. A method of producing thermoplastic hydrogels as in Claims 19 and 21 wherein, excess OH groups are capped with one or more molecules from the list of;
mono-isocyanate ended aromatic molecules,
mono-acid anhydride ended aromatic molecules,
mono-isocyanate ended aliphatic molecules,
mono-acid anhydride ended aliphatic molecules
reaction product of a monoamine with a di(or higher) isocyanate.

27. A method of producing thermoplastic hydrogels as in Claims 19-26 wherein the groups used in the endcapping process allow the polymers to interact with physical or chemical cross-linking.

28. A thermoplastic hydrogel for use in producing contact lenses, prosthetic lenses or cosmetic lenses produced by the methods described in Claims 1-27.

29. A thermoplastic hydrogel as in Claim 28 wherein the hydrogel is completely polymerised under the specific conditions that are being used.

30. A thermoplastic hydrogel as in Claims 28 and 29 wherein after polymerisation the hydrogel is heated.

31. A thermoplastic hydrogel as in Claims 28 and 29 wherein after polymerisation the hydrogel is immersed in water liquid or vapour.

32. A thermoplastic hydrogel as in Claims 28 - 31 wherein the hydrogel may be pelletised, pressed, extruded or heat, pressure, injection or compression moulded.

33. A thermoplastic hydrogel as in Claims 28 - 32 wherein the end product incorporates an antioxidant containing two or more hydroxyl groups.

34. A thermoplastic hydrogel as in Claim 33 wherein he antioxidant may be internal or external.

35. A thermoplastic hydrogel as in Claims 33 and 34 wherein the antioxidant is ascorbic acid.

36. A thermoplastic hydrogel as in Claims 33 and 34 wherein the antioxidant is 2,6-ditertiarybutyl4-hyroxanisole.

37. A thermoplastic hydrogel as in Claims 28 - 36 wherein the hydrogel develops opacity when swollen in water.

38. A thermoplastic hydrogel as in Claims 28 - 37 wherein the hydrogel incorporates dye(s).

39. A thermoplastic hydrogel as in Claims 28 - 38 wherein the hydrogel incorporates pigment.

40. A contact lens, prosthetic lens or cosmetic lens produced from the hydrogel of Claims 28-39.